Purpose: To analyze difference of guidance for daily setup verification between kilovoltage (kV) Cone Beam Computed Tomography (CBCT) and electromagnetic tracking system (Calypso) for prostate cancer patients receiving Intensity-Modulated Radiation Therapy (IMRT).

Methods: Sixteen prostate patients' data sets were analyzed. The daily treatment table shifts given by CBCT and Calypso systems to bring the patient's Planning Target Volume (PTV) to isocenter were noted. Calypso transponders were used as fiducial markers and patients shifted based on CBCT findings. Calypso system was then utilized to show the setup (residual) error. 577 CBCT images and Calypso data pairs were analyzed, with three shifts recorded for each. The number of times in which the shift difference (in absolute terms) between CBCT and Calypso agreed within 3 mm was recorded. Then the vector length of the residual errors determined by Calypso was calculated and compared to the 3D Clinical Target Volume (CTV)-PTV margin (8 mm).

Results:There were 424 cases (73.5 %) where the shift differences between CBCT and Calypso agreed within 3 mm in all three orthogonal directions. After the patient was shifted to isocenter by the CBCT data, there were 526 cases (91.2 %) where the vector length of the residual errors determined by Calypso was less than 8 mm and thus within the PTV margin; a frequency distribution for residuals gave a median vector of 4.3 mm.

Conclusions: The CBCT and Calypso systems are complimentary for daily setup verification in IMRT prostate patients. Residual error due to intrafraction motion was less than 5 mm after CBCT alignment. Hence, margin reduction appears feasible allowing for further dose escalation. In addition, shape deformation data provided by CBCT for prostate and Organs at Risk (OARs) essential for facilitating real-time geometric treatment adjustments.